N/ECD

4

EOC 8-35822 FR 1

N84-29194

ELECTRO-OPTICS CONSULTANTS
INCORPORATED

30 April 1984

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

SUBJECT: Final Report for Contract NAS8-35822
"Feasibility Study of a Color Film Preservation System"

Gentlemen:

The attached final report is submitted to fulfill the reporting requirements on the subject contract for the total period of performance.

Sincerely,

J.H. McDermit
Program Manager

JHM/ilb

encl.

Report Distribution:

AP29-F
AS24-D
AT01
NASA Scientific and Technical
Information Facility

John R. Richardson / AT01

FINAL REPORT

COLOR FILM

PRESERVATION SYSTEM

-BREADBOARD DEVELOPMENT-

CONTRACT -- NAS8-35822

THIS REPORT WAS PREPARED

FOR

THE TECHNOLOGY UTILIZATION OFFICE

AT01

SUBMITTED TO:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, AL 35812

SUBMITTED BY:

ELECTRO-OPTICS CONSULTANTS, INC.
2512 GARTH ROAD
HUNTSVILLE, AL 35801

30 APRIL 1984

TABLE OF CONTENTS

SUMMARY OF RESULT

During this interim study the following have been accomplished:

- Additional leakage data was collected on the cylindrical storage concept developed during Phase I. Results indicate that long term storage is feasible with this concept.
- A system was designed and fabricated for collecting oxygen content data for use during Phase II of the study.
- A breadboard of an operational system was built for the purpose of collection of data and for the purpose of system demonstration.

Details of these results are presented in this report.

BACKGROUND

It has been determined that high speed color transpariences made from film such as Ektachrome and Fujichrome experience dye fading in a relatively short period of time. These films are used in the medical profession to record the retinal reflex images of individuals. It is important to keep these records from deterioation in order to keep medical histories for diagnosis, preventative care, etc.

Further, significant degradation of valuable skylab experiment film was noticed in 1974. The specific film of concern was the SO-242 film flown on ATM experiment S-056 during Skylab 4. Degradation occured in color balance changes resulting

from organic dye instability (REF.1). In 1975 action was taken to quantify the rate of degradation and to store the film in an enviroment to decrease or stop degradation (REF.2). Accelerated tests were conducted at MSFC that indicated that dye fading of the film could be totally arrested or greatly retarded by placing the film in a nitrogen environment. The film was stored in the nitrogen enviroment and after a period of 29 months it was found that the storage system was highly successful.

It was the objective of Phase I of this study to determine the feasibility of developing an economically feasible system to prevent and/or substantially reduce the degradation of the color dyes of the retinal reflex images recorded on color slide films. This study drew upon the system developed by NASA-MSFC to preserve Skylab films. This system basically consists of a sealed container containing a dry nitrogen gas (GN_2) and is patented under:

"METHOD FOR RETARDING DYE FADING DURING ARCHIVAL STORAGE OF DEVELOPED COLOR PHOTOGRAPHIC FILMS"

PATENT NO: 4,287,152

The objective of Phase I of this study was accomplished by designing, fabricating, and testing three different types of film storage systems. In Phase I it was concluded that an extruded plastic container such as that shown in Figure 1, could be developed into an economically feasible concept for storing films for extended periods of time. (REF.4)

OBJECTIVES

The following are the objectives defined for the interim effort between Phase I and Phase II of this study.

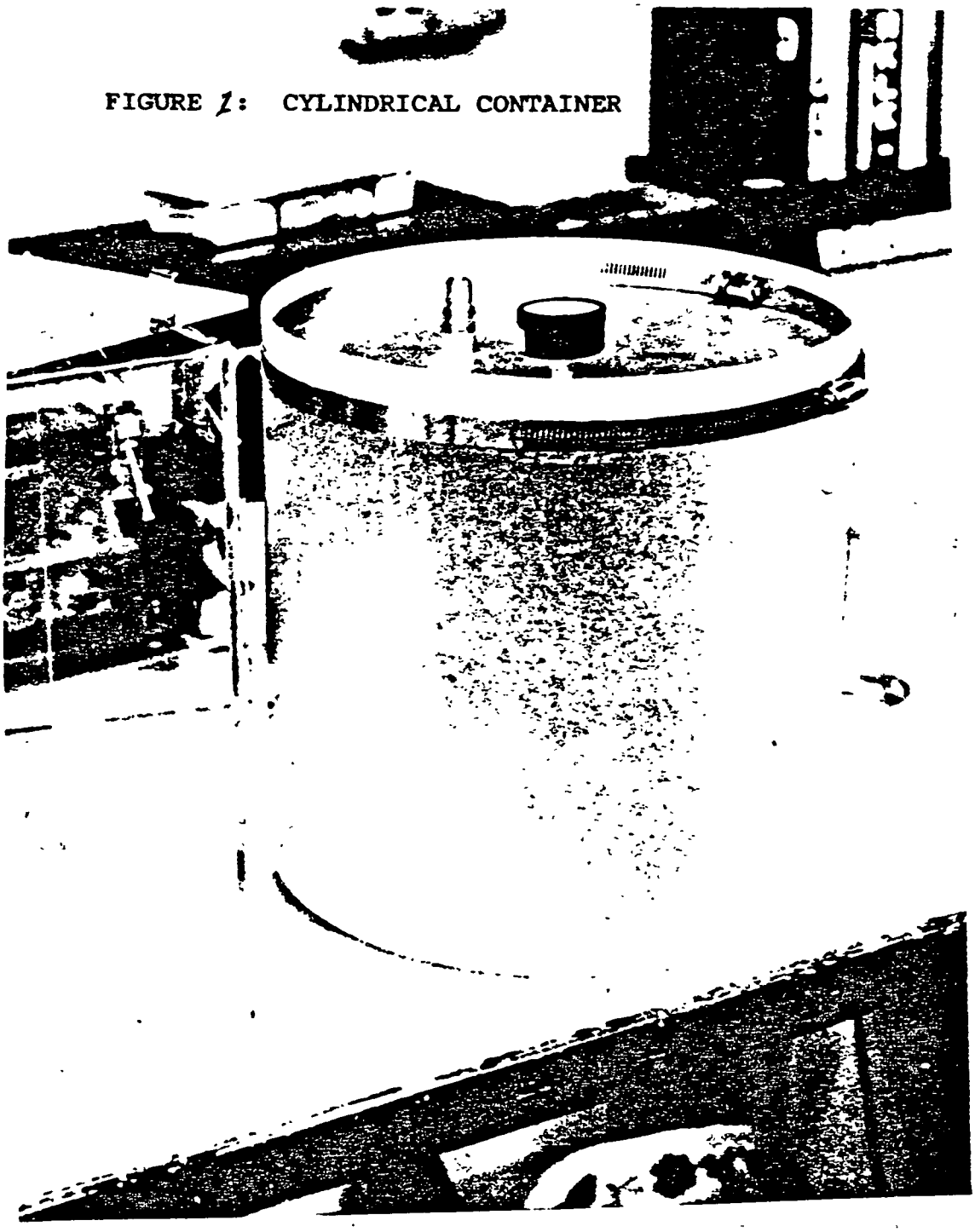
- Continue collecting leakage data on the cylindrical concept
- Design a system for collecting oxygen content data for use in Phase II.
- Build a mock-up of the system planned for mass storage.

RESULTS

The cylindrical container was pressurized and no observable leakage occured, indicating that long term storage is feasible with this concept.

A survey was conducted to determine the availability, accuracy, cost, etc., of equipment available for measuring oxygen content. Oxygen content data is required to determine storage system purging requirements, the feasibility of attaining oxygen

FIGURE 1: CYLINDRICAL CONTAINER



levels low enough to minimize degradation, and the economics of the system in general from the viewpoint of the nitrogen requirements. It was found that an electro chemical fuel cell type sensor was best for the application being studied (REF.5). A survey of this type sensor was made and one was selected and purchased for the breadboard.

BREADBOARD DESIGN

The original objective was to build a mock-up of the system for storage. This mock-up was to include mock-ups of N_2 storage, monitors, etc. However, the decision was made that it would be more practical to build an operational breadboard by utilizing additional contractor funds. This system has been fabricated and is operational. A schematic of the system is given in Figure 2 and a photo of the system in its carrying case is shown in Figure 3.

This system offers the capability to determine:

- Purging requirements to achieve various levels of oxygen concentration.
- Precise leakage of various container configurations.

This system has the following features:

- Digital display of oxygen content of container.
- Automatic control of oxygen content of container.
- Automatic control of container to atmosphere pressure differential.
- Flow rate readout during purging.

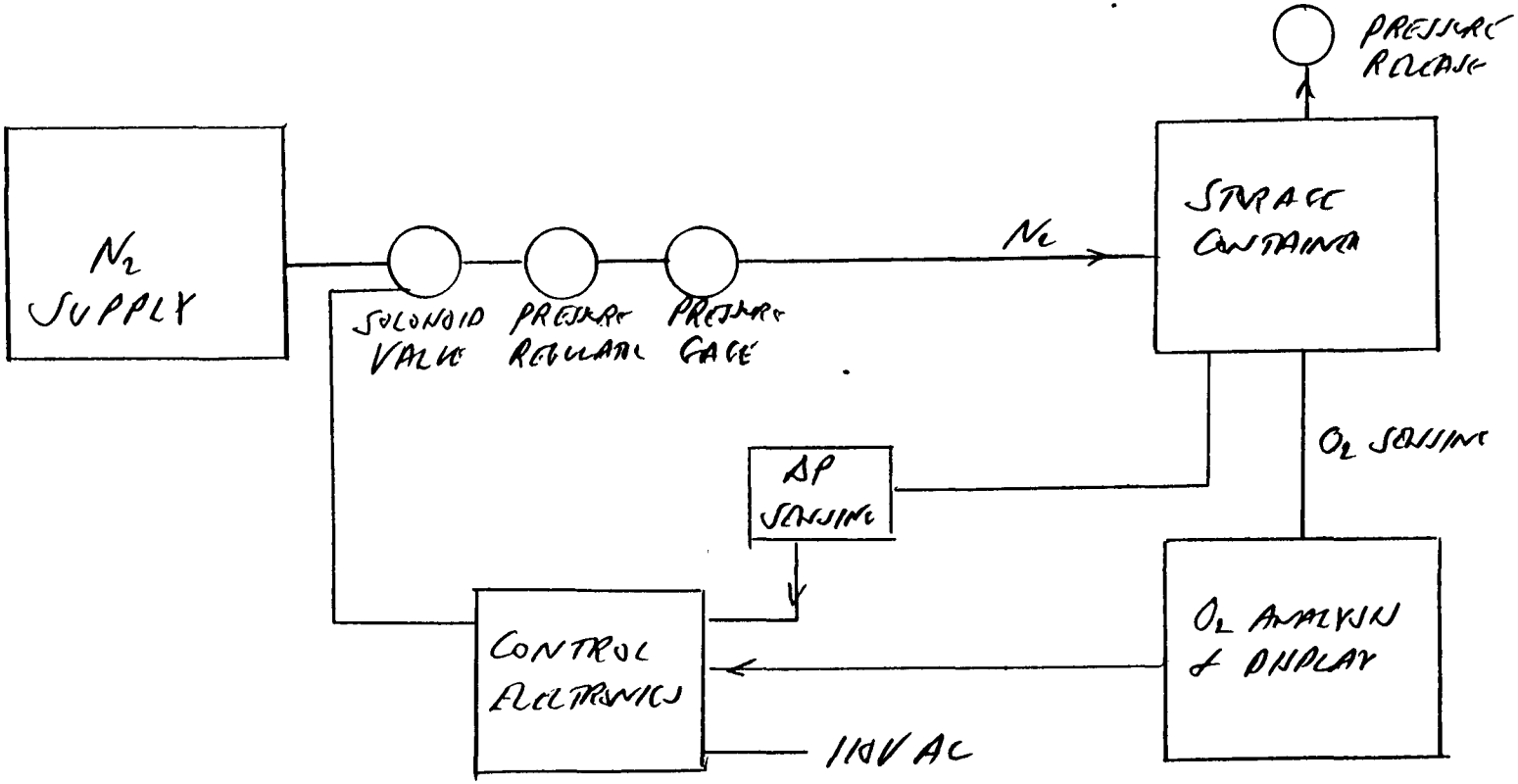


FIGURE 2: SYSTEM SCHEMATIC

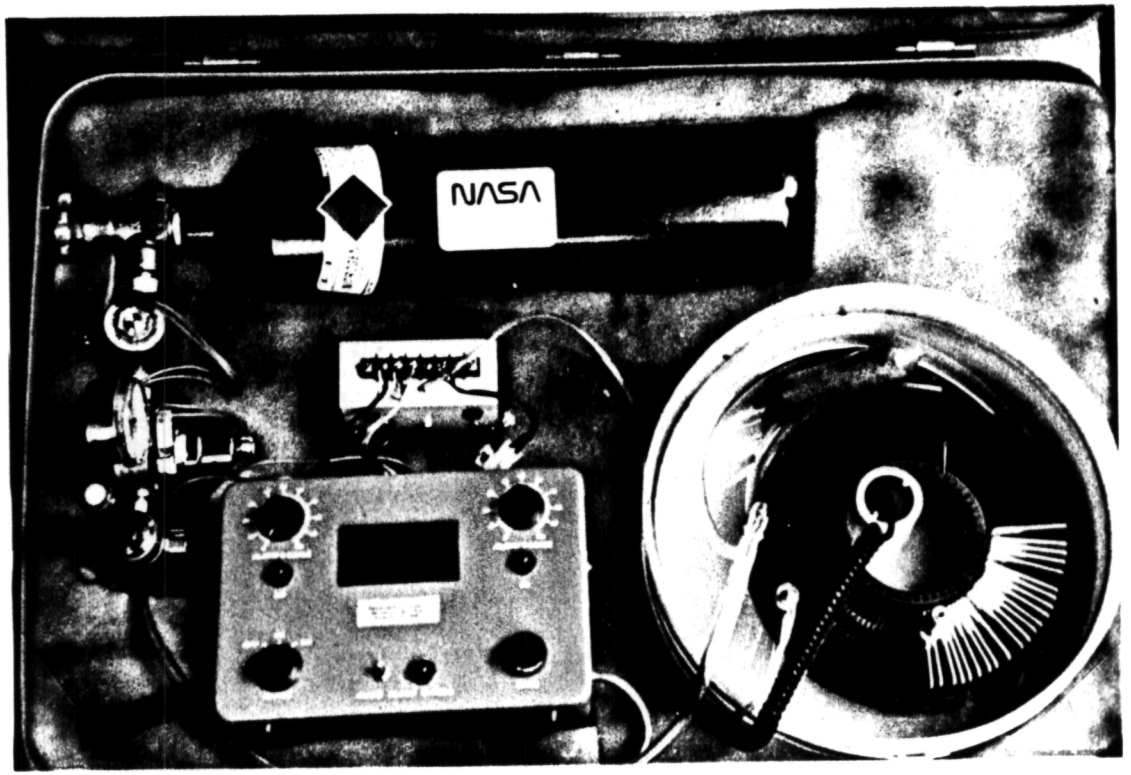


FIGURE 3: SYSTEM IN CARRYING CASE

CONCLUSIONS

A breadboard has been fabricated that will provide valuable data for prototype design during Phase II of this study. Further, with the compact packaging of the breadboard it provides a system that can be used to demonstrate the concept.

REFERENCES

1. NASA internal letter from ES13/Dr. A.C. DeLoach to ES13/Richard Hoover, SUBJECT: Stability of Color Films Used in the ATM Experiment S-056. September 25, 1974

2. NASA internal letters from Einar Tandberg-Hanssen, S-056 Principal Investigator to Mr. John R. Brinkmann, Chief, Photographic Technology Division. March 21, 1975 and April 3, 1975.

3. NASA internal letter from ES/51 Dr. Einar Tandbert-Hanssen to ES62/Richard B. Hoover, SUBJECT: Status of SO-242 color flight film from ATM experiment S-056. August 30, 1977

4. "Color Film Preservation System - A Feasibility Study" Contract NAS8-35335, Electro-Optics Consultants, Huntsville, Alabama, August, 1983.

5. MEASUREMENT OF OXYGEN, proceedings of an interdisciplinary symposium held at Odense University, Denmark, 26-27 September,1974, H. Degn, I. Balsleu, and R. Brook, editors, Elsevier Scientific Publishing Co., 1976.